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Classifying The Standards Via Revised Bloom's Taxonomy: A Comparison of Pre-Service and In- Service Teachers

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ABSTRACT

The aim of this study is (a) to investigate the usefulness of Bloom's revised taxonomy (RBT) for classification of standards, (b) to examine the differences and similarities between pre-service teachers' and in-service teachers' classification of the same standards and (c) to determine which standards are vague and broad. The 45 standards, in the Turkish 10th Grade Physics Syllabus, were categorized by the 16 participants, who were divided into two groups. The first group included eight pre-service physics and the second group included eight in-service physics teachers, in Turkey. Firstly, each participant classified the standards using RBT individually, then, they classified the standards with their group. We compared their all classification of standards. The usefulness of Revised Bloom Taxonomy for classification of standards, the differences between individually classification and the groups' and, differences between the pre-service and in- service teachers groups' classifications, (c) the standards which are broad and vague were discussed.

KEYWORDS
Revised Bloom's Taxonomy; classifying standards; pre-service teachers; in-service teachers; physics syllabus

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Introduction

What students are supposed to know, what they are expected to learn in each subject, what students should have learned/acquired by the end of a subject or a course and how the students should attain knowledge are defined as standards (Tyler, 1949; Bloom, 1956; Anderson and Krathwohl, 2001). Standards guide the instructors in selecting/developing the content, developing an instructional strategy, and assessment instruments. Standards are not only necessary for instruction design, but also necessary for instructors, students, curriculum supervisors, and administrators. They help the students to know what they are

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supposed to learn. Curriculum supervisors and administrators will be able to develop quality assessment instruments based on these standards and implement quality management systems. Standards are used as a tool by schools and teachers to focus on learning outcome. Standards should help teachers to monitor achievement and to develop programs that improve student learning and can be used by teachers as a reference point for learning programs, for planning teaching process and for assessing. According to Skilbeck (2007);

> "Without clearly formulated and precise standards it is difficult to prepare valid tests and other forms of assessment. This point is of great significance to the student, who is entitled to know, in advance, at least the general outlines of what he is expected to do in order to perform adequately. The existence of clear and detailed standards is a help to both teachers and students in judging progress towards attainment of a goal. Having a clear idea of standards enables the teacher in the classroom to pick out of the lightly structured teaching-learning situations which are now so common, (projects, visits, case-studies, discussions, etc.), elements of potential significance, and to build on these."

As Skilbeck (2007) said that the existence of clear and detailed objectives/standards is a help to both teachers and students in judging progress towards attainment of a goal. However, interpretation of standards is based on teachers' judgments, and, if the standards interpreted similarly or differently by teachers, the outcomes will be similar or different. Because, how the standards are interpreted by teachers/instructors is important for planning of teaching and for learning outcomes. So, it is important that teachers agree on their interpretation of standards and teachers have to interpret the standards similarly to get equivalent in their own country or region. But, researcher state that many standards are broad and vague (Patton and Trainor, 2003; Popham, 2003; Wiggins and McTighe, 2005; Luft, Brown, and Slutherin 2007; Näsström, 2009) and this may affect the interpretation of standards. Then, how we may determine the differences and similarities of interpretation of standards, and, which standards are broad and vague is an important question.

According to some researchers (O'Neil and Murphy, 2010; Näsström, 2009), standards can be classified and interpreted in a variety of ways and a taxonomy may be useful. Also, Anderson and Krathwohl (2001), and Krathwohl (2002) stated that t*he Taxonomies is a scheme for classifying educational goals, objectives, and, most recently, standards. It provides an organizational structure that gives a commonly understood meaning to objectives classified in one of its categories, thereby enhancing communication.* By classifying/interpreting the standards into cells of a taxonomy, whose aim is to make standards clearly understandable, we can see the structure of the standards. Thus, we can see differences and similarities among judges such as teachers, pre-service teachers and experts while classifying the standards.

There are many taxonomies, such as Bloom's original taxonomy (1956), Guilford's taxonomy (1967), SOLO taxonomy (Biggs and Collis, 1982), Porter's taxonomy (Porter and Smithson, 2001), Bloom's Revised Taxonomy-Revision of original- (Anderson and Krathwohl, 2001), Dettmer taxonomy (2006), and Marzano's new taxonomy (Marzano and Kendall, 2007), can be used to interpret

standards. But, in this study the RBT (Revised Bloom's taxonomy) was selected and used as a tool for classifying standards.

Why Did We Use Revised Bloom's Taxonomy (RBT)?

Some of the reasons for using the Revised Bloom's Taxonomy in this study include:

1. RBT is a classification of learning objectives within education that educators set for students (Krathwohl, 202). It is important to establish intended learning outcomes in professor/student interactions so that both parties understand the purpose of the interactions. Developing intended learning outcomes using RBT helps faculty to design and implement appropriate assessment tasks, measures, and instruments. Having intended learning outcomes based on RBT helps to ensure that instruction and assessment are appropriately aligned with the intended outcomes. The RBT is designed for developing learning objectives, teaching and assessment among these main components of an educational system (Näsström, 2009).
2. Näsström (2009) compared two taxonomies, RBT and Porter's, in order to assess their usefulness for alignment analysis based on Hauenstein's five rules and on inter-judge reliability, she found out that Bloom's revised taxonomy empirically was more useful than Porter's model. Bloom's revised taxonomy is useful for interpretation of standards and taxonomy is found to be the most useful model for classification of standards.
3. In another study where standards in chemistry and mathematic were categorized in two different types of models, Bloom's revised taxonomy was found to interpret the standards more unambiguously than a model with topics-based categories and it is the most useful classification tool today and it is a useful tool for interpreting the standards (Näsström and Henriksson 2008; Näsström, 2009).
4. Arı (2008) stated that Bloom's Taxonomy is widely used and has been concerned with the international stage, and it's the mostly used and well-known taxonomy in educational settings. The use of this taxonomy is not limited to the US, it has been used all over the world.
5. Krathwohl (2002) stated that RBT has many merits on the usage as a tool to analyze the learning objectives, it could serve as a common language about learning objectives, and RBT provides teachers and educators with a common frame of reference that clarifies various types of learning outcomes.
6. RBT has been developed for all academic subjects and allows comparisons of standards from different subjects and teachers need a framework to help them to make sense of objectives and organize them so that they are clearly understood and fairly easy to implement (Anderson and Krathwohl, 2001). The RBT has been applied to both pre-school education and higher education and to all types of academic subjects.
7. When pre-service teachers learn about writing instructional objectives, they are typically asked to categorize or label each one according the Bloom's level of cognitive complexity (Gronlund, 2004). Borich, Tombari and Tombari (2004) found that the taxonomy benefits teachers in planning

their lessons. It helps teachers to focus on the outcomes, specifically instructional objectives, which they want their students to attain as a result of instruction.

8. Finally, the RBT, well known taxonomy in Turkey and it is taught to pre-service teachers in their education by instructors and it is used by in-service teachers at school and educators training students to become teachers often refer to Bloom's Taxonomy during each aspect of the instructional cycle, from planning to assessing instruction (Arı, 2008).

Literature Review

There are many studies about RBT; from classification of questions of any subject to produce a quality exam paper via or based on the RBT. Also, there are different studies from to enhance students' learning in biology (Crowe, Dirks, and Wenderoth, 2008), to challenge students' thinking (Vrchota, 2004), from to develop critical thinking (Athanassiou, McNett, and Harvey, 2003), to develop a planning tool to differentiate curriculum (Noble, 2004), from to interpret standards (Nasström, 2009), and to teach students about plagiarism (Vosen and Fink, 2008).

Indeed, the importance of categorizing standards with RBT was addressed by Anderson and Krathwohl, (2001) and Krathwohl (2002) stated that using the RBT table (see Figure 1) to classify or to interpret the objectives, activities, and assessments provides a clear, concise, visual representation of a particular course or unit and indicate that the teachers can use the RBT for classifying standards/objectives. Bloom's Taxonomy provides an established, useful and comprehensive framework for identifying/writing/interpreting instructional objectives (Gronlund, 2004). It's said that RBT can be used to categorize objectives, but person(s) doing the classification should make correct inferences. And individuals may disagree on the accurate classification of an objective.

However, there is lack of studies that examine the usefulness of RBT for classification/interpretation of standards/objectives differences and investigation similarities among judges' classification of standards, and determine the disagreement about the correct classification of a standard. Accordingly in this study, while searching for literature review we found a few studies, like Näsström (2009), -who studied differences and similarities between teachers and assessment experts when they interpreted standards by means of the taxonomy, She investigated the differences between the teachers and the assessment experts when interpreting the standards of mathematic syllabus. The teachers utilized the categories in RBT to a larger extent, multi-categorized to a lesser extent, and had lower levels of inter- and intra-judge consistency than the assessment experts. The assessment experts were more consistent in their interpretation of standards. According to her conclusions, agreement on interpretation of standards had to increase, especially for teachers.

Due to the lack of studies, this study should be carried out. And, this study focuses on (a) the usefulness of RBT for classifying the standards, (b) the similarities and differences between pre-service teachers and in-service teachers' classifications and (c) the vague and broad standards of 10th grade physics syllabus, in Turkey, during the pre- and in- service teachers classifying the standards, by using the RBT. The main questions of the study are as follows:

1. Is the RBT useful in the categorization of standards?

2. What are differences and similarities while classifying standards?

a) What are differences and similarities among individuals, groups (4 judges) and final (8 judges) classification of pre-service teachers?

b) What are differences and similarities among individuals, groups (4 judges) and final (8 judges) classification of in-service teachers ?

c) What are differences and similarities between pre-service teachers' and in-service teachers' classification of standards?

3. Which standards are vague and broad?

To answer the first question, we took into consideration the Hauenstein's (1998) five rules. According to Hauenstein, a taxonomy should (a) be applicable; (b) be totally inclusive, i.e. all standards can be categorized; (c) have mutually exclusive categories, i.e. unambiguously categorize one standard into only one category; (d) follow a consistent principle of order; and (e) use the terms in categories and subcategories that are representative of those used in the field. To answer second question Percent Agreement, Krippendorff's alpha, Cohen's kappa and, Emphasis Index were used to determine the differences and similarities between/among pre- and in- service teachers' classification and to calculate intra-rater, inter-rater consistency. And, to answer third question the agreement level was used.

Method

Two groups of pre-service and in-service teachers classified the same standards (10th grade physics syllabus) with Bloom's Revised Taxonomy under similar conditions. The participants of these two groups were compared regarding inter- and intra-judge agreement. The list of verbs appropriate for the levels of Bloom's taxonomy (the cognitive domain, see figure 2) was also used in clarifying the process of classification. The study was performed using the document analysis method within the framework of qualitative research. Document analysis is the process of collecting records and documents on the relevant subject and examination by coding them according to a system and certain norms (Creswell and Clark, 2011).

Revised Bloom's Taxonomy(RBT)

Bloom's original cognitive taxonomy (1956) was revised and modified in order to remove adapt it for 21. century World (Arı, 2008). The important change of new taxonomy is that it is two-dimensional instead of one-dimensional. The verb and noun forms are separated from each other into two dimension: *Knowledge Dimension* and *Cognitive Process Dimension* (Krathwohl and Anderson, 2001; Amer, 2006).

The knowledge dimension is a different type of knowledge: *Factual* (knowledge of terminology, knowledge of specific details and elements), *conceptual* (knowledge of classifications and categories, knowledge of principles and generalizations, knowledge of theories, models, and structures), *procedural* (knowledge of subject-specific skills and algorithms, knowledge of subject-specific techniques and methods, knowledge of criteria for determining when to use appropriate procedures), and *metacognitive* knowledge (strategic knowledge, knowledge about cognitive tasks, including appropriate contextual and conditional knowledge, self-knowledge). This dimension focuses on content as types of knowledge, and according to Krathwohl and Anderson (2001), to lie along

a continuum, from concrete in factual knowledge to abstract in metacognitive knowledge.

The cognitive processes dimension is intended to provide a comprehensive set of classification for students' cognitive processes that are included in objectives (Krathwohl and Anderson, 2001). The categories in this dimension are *remember, understand, apply, analyze, evaluate* and *create*. This dimension represents a continuum of increasing cognitive complexity, from lower order thinking skills (remember) to higher order thinking skills (create).

Bloom's revised taxonomy table consist of two-dimension and compose of 24 cells (see Table 1, adapted from Anderson and Krathwohl, 2001, p.46). The rows in the taxonomy table represent the four categories of the knowledge dimension and the columns the six categories of the cognitive process dimension. Columns are used to represent the verbs in the objective and rows are used to represent the nouns in the objective. One standard will thereby be categorized according to the two dimensions and placed in the corresponding cell(s) in the taxonomy table. Finally, each objective can be classified in one cell or more than one cell. (Amer, 2006; Krathwohl, 2002). But in this study each objective can be classified just one cell.

Table 1. Revised bloom's taxonomy table

	Remember		Understand						Apply		Analyze			Evaluate		Create		
	Recognizing	Recalling	Interpreting	Comparing	Exemplifying	Classifying	Summarizing	inferring	Explaining	Executing	Implementing	Differentiating	Organizing	Attributing	Checking	Critiquing	Generating	Planning	Producing
Factual knowledge	Cell 1								Cell 2	Cell 3		Cell 4			Cell 5		Cell 6		
Conceptual knowledge	Cell 7								Cell 8	Cell 9		Cell 10			Cell 11		Cell 12		
Procedural knowledge	Cell 13								Cell 14	Cell 15		Cell 16			Cell 17		Cell 18		
Metacognitive knowledge	Cell 19								Cell 20	Cell 21		Cell 22			Cell 23		Cell 24		

How the RBT Can Be Used?

Standards must fall under one of the four categories under the knowledge dimension, and under one of the six categories of the cognitive process dimension. Use the *noun* in the objective to determine what is being learned: factual, conceptual, procedural, or meta-cognitive knowledge (the rows in the taxonomy table). The *verb* used in the learning objective will determine which cognitive process dimension column the objective falls under: remember, understand, apply, analyze, evaluate, and create (the columns in the taxonomy table). The objective is then placed in the corresponding cell in the taxonomy table, where the knowledge and cognitive process dimension intersect. For example, it can be seen in the Figure 1. How a pre/in-service teachers placed one objectives into cell.

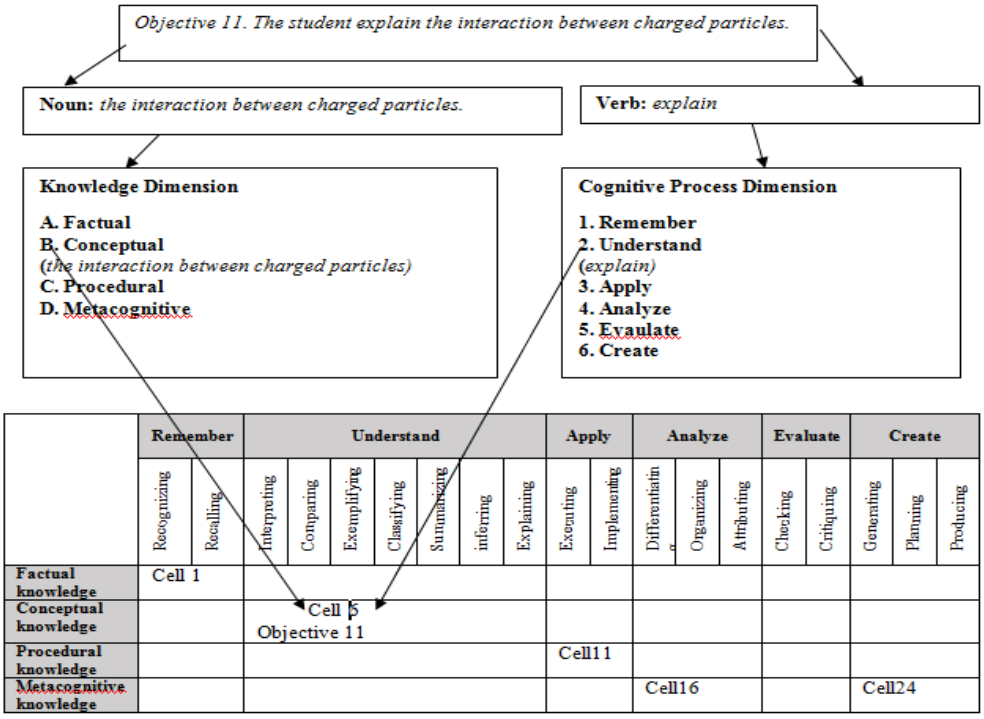

Figure 1. How an objective is classified in the taxonomy table?

Participants: The Pre-Service and In-Service Teachers

Eight pre-service and eight in-service teachers participated in this study. The pre-service teachers were at the their last semester (10th semester) to graduate from department of secondary science and mathematics education, faculty of education. The department aims particularly to equip students with the up-to-date knowledge and practical skills required for secondary school mathematics and science teachers. An important objective of the department is to provide its graduates with relevant contemporary information, training, and prerequisite skills to enable them to guide their students to cope with the challenges of the 21st century. Their graduate program consist of content of physics (i.e mechanic, optic, electricity and magnetism), and Educational Psychology, Curriculum Development and Instruction, Theories and Approaches in Teaching and Learning of Science, Measurement and Evaluation, Computer Applications, Instructional Technology and Material Development, Classroom Management, Turkish Educational System and School Management, Practice Teaching at Schools, Research Projects in Science. After graduating from faculty of education, the prospective teachers attain a national exam, KPSS, to be in-service teachers. The KPSS consist of 80 multiple choose questions that deal with their subject (i.e Educational psychology, Curriculum development etc.) and 50 multiple questions includes content of physics as average a pre-service/prospective teachers should correct 70/80 of the first section and 35/50 of the second section to be teacher at national high school.

The in-service teachers working at high school. They teach students from 9th to 12th grade. They have at least 3 years of experiences.

As a result, we can say that both pre-service teachers and in-service teachers are similar with curriculum, syllabus, Bloom Taxonomy and the 10th grade physics syllabus objectives and content.

The standards/objectives

In Turkey, a curriculum is defined by a policy document for each educational level. The aim of the physics curriculum (9th-12th grade) is to improve scientific literacy and the scientific process abilities of students. The curriculum of physics which include 9th and 10th grades deals with the basic terms of physics. It is within the frame of this program that students be able to attain both functional and conceptual knowledge and apply them to different and new situations. The 11th and 12th grade education curriculum reveals the same concepts more-detailed and linking with other physical concepts. Hence the aim of this program is to prepare the students for university or for a choice of physical-related carrier. Therefore, it is intended that 11th and 12th grade students be able to continue their studies in a field related to physics alongside with learning it.

A syllabus in Turkey is a policy document for one subject, for example 10th grade physics syllabus (TTKB, 2013), at a specific educational level, containing one type of standards. The standards of the 10th grade physics syllabus is that students be able to interpret basics about optics, magnetism, electricity, force, pressure which are components of physics without having to deal with detailed mathematical knowledge. There are 4 subjects and 45 standards in 10th grade physics syllabus (see Table 2).

Table 2. 10th grade physics syllabus (TTKB)

Unit no	Unit name	The number of objectives	Time	
			Class hours	Percentage
1	Pressure	4	10	13,9
2	Magnetism, electricity	13	22	30,6
3	Wave	11	16	22,2
4	Optic	17	24	33,3
	Total	45	72	100

Procedure and Data Gathering

The study was planned in the spring semester of 2013-2014. By meeting an academician who has experience and studies on Bloom taxonomy and revised taxonomy (Kocakaya and Gonen, 2010) both the aim, importance and context were fully explained. After this deciding to participate 13 pre-service teachers were inquired whether to take part in the study or not. And the process started after the approval of 8 of them, but we waited for the 2014-2015 spring term so as to apply Bloom taxonomy.

The detailed stages of the process are as follows:

1. Being an expert on taxonomy associate professor fully explained how to categorize the standards into RBT, and the original taxonomy in 4 weeks and 3 hours per each week. (Week 1)

2. The instructor categorized the objectives of 9th grade syllabus with RBT by working with pre-service teachers in 2 weeks so that they gain experience. Verb list (figure 2) was used while categorizing. (Week 3).

Revised Bloom's Taxonomy of the Cognitive Domain					
Cognitive Level	**Sample Verbs to Use in Writing Intended Student Learning Outcomes**				
Remembering	Define Duplicate	Identify List	Name Recall	Recognize Reproduce	Retrieve Tell
Understanding	Calculate Categorize Clarify Classify Compare	Conclude Contrast Describe Discuss Exemplify	Expand Explain Identify Illustrate Infer	Interpret Locate Match Outline Paraphrase	Predict Report Restate Summarize Translate
Applying	Carry out Classify	Demonstrate Execute	Illustrate Implement	Practice Solve	Use Utilize
Analyzing	Appraise Attribute Compare Contrast	Deconstruct Detect Differentiate Discriminate	Distinguish Examine Formulate Infer	Integrate Organize Parse Relate	Select Sequence Structure Test
Evaluating	Appraise Check Coordinate	Critique Defend Detect	Dispute Judge Monitor	Prioritize Rate Reconstruct	Select Support Verify
Creating	Change Combine Compile	Compose Construct Create	Design Formulate Generate	Hypothesize Improve Invent	Plan Predict Produce

Figure 2. The verb list.

3. 10th grade physics syllabus objectives (45 objectives, see table 2), The RBT tables (see Table 1) and verb list (Figure 2) were given to pre-service teachers and they were asked to categorize each objective individually. (see Figure 1). (Week 4). Each participant was coded as P1, P2 so on.
4. They were divided into 2 groups each of which included 4 pre-service teachers in week 4. The groups were selected from different classes. Each of them was asked to re-group the 45 standards and they were recorded as GA1 and GA2.
5. 8 teachers clubbed together (final) and categorized the 45 standards after an evaluation and discussion and coded it as FA.
6. Therefore all of the 45 standards were initially categorized individually (i.e P1,P2…) next in four (i.e GA1,..) and eventually in eight (FA) by pre-service teachers. After gathering information from the pre-service teachers was completed, the process of gathering information from in service teachers started.
7. Visiting the schools nearby the teachers willing to participate were selected. While selecting it was paid the utmost care that teachers be experienced and have knowledge on taxonomy.
8. Having selected 8 teachers each being from a different school each teacher was given a file of memorial and descriptive information about RBT and information about how to classify the standards of 9th grade. Moreover they were given 10th grade objectives, table and verb list and were asked to categorize these in a week.

9. The categorizations of 8 teachers were taken individually and were coded as T1,T2 but data gathering process was ceased as it was summer holiday.
10. In September 2015 teachers were divided into 2 groups of four. These groups came together on different days and locations and did categorizations. The former was coded as GT1 and the latter as GT2.
11. After 12 days all of the 8 teachers came together and made a final categorization to be called (FT) by in-service teacher, as done by pre-service teachers previously. (See Figure 3)

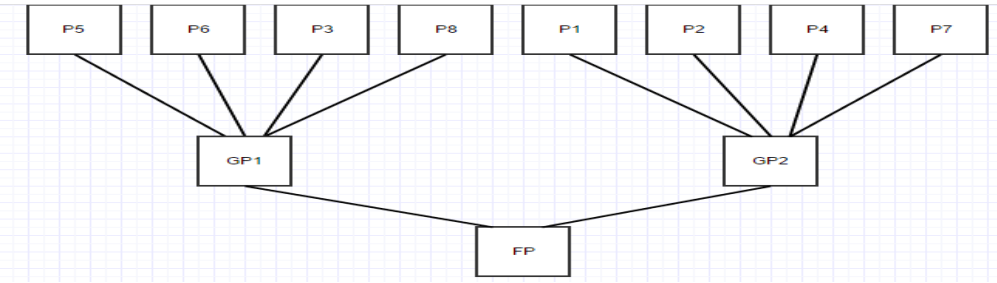

Figure 3. The process of classification of objectives by pre-service teachers, P. The same process carried out for in-service teachers, as well.

Data Analysis

To the end of the study 22 worksheets were gathered; 16 of which individual (8 of in-service and 8 of pre-service teachers'), 4 of which that of groups (2 of pre-service and 2 of in-services teachers') and 2 of which belonging to final studies.

How the data were analyzed and which statistical methods were used and why the method were used explained in detail as follows:

In this study (1) *Average Pairwise Percent Agreement*, (2*) Krippendorff' s alpha (a)*, (3) *Cohen's kappa*, (4) The frequencies and percentages and, (5) *Emphasis Index* were used to determine the differences and similarities between/among pre- and in- service teachers by calculating intra-rater, inter-rater consistency, both two and more than two raters. And the *agreement levels* were calculated to determine how many participant classified the standards into cell.

1. In both individual, group and final categorizations the frequency and percentage of the cells both used and not-used in the taxonomy chart will be given thereby enabling us to make comparisons both within and between groups. (See figure 3). The statistical analysis of inter- and intra-judge consistency for panels as wholes is based on how the standards are distributed in the taxonomy table for all judges in each panel. The percentage of the total number of classifications of all standards is presented in a taxonomy table for each panel on each occasion.
2. Average Pairwise Percent Agreement will make the number of standards, similarity percentage of in and inter-groups done by teachers available.
3. Average Pairwise Cohen's Kappa (Inter-rater consistency) will make available the consistency rate of in-group of teachers. And eventually the consistency rate of both panels will appear. *Cohen's kappa coefficient* is a statistic which measures inter-rater for qualitative (categorical) items. It is generally thought to be a more robust measure than simple percent

agreement calculation, since κ takes into account the agreement occurring by chance. It works when assessing the agreement between two raters. In this study to evaluate the comparisons of GA1 and GA2 , GT1 and GT2 , and finally of A1 and FT1 this scale will be employed.

4. Krippendorff's Alpha (nominal) will let us make inter/intra rater calculations. Because of multiple judges and the data on nominal level, *Krippendorff's alpha* (α) are used in this study. Hayes and Krippendorff (2007) have gone through why this analyze would be used in this study. Krippendorff's alpha (α) is a reliability coefficient developed to measure the agreement among observers, coders, judges, raters, or measuring instruments drawing distinctions among typically unstructured phenomena or assign computable values to them. It is general in that it can be used regardless of the number of observers, levels of measurement, sample sizes, and presence or absence of missing data. α emerged in content analysis but is widely applicable wherever two or more methods of generating data are applied to the same set of objects, units of analysis, or items and the question is how much the resulting data can be trusted to represent something real. Its extension to many observers is stated in analysis of variance terms. Thus, α is in good company. Alpha also allows for reliability data with missing categories or scale points, a frequent reality that none of the reviewed measures has been able to cope with (Hayes and Krippendorff, 2007). Landis and Koch (1977) gave the following table for interpreting values.

Table 3. Interpreting values of κ

Interpretation	κ
Poor agreement	< 0
Slight agreement	0.01 – 0.20
Fair agreement	0.21 – 0.40
Moderate agreement	0.41 – 0.60
Substantial agreement	0.61 – 0.80
Almost perfect agreement	0.81 – 1.00

In this study Krippendorff's scales will be used in explanation and discussion first for the individual studies of both pre and in-service teachers and then for G1+G2+F categorizations.

4. The frequencies and percentages of standards with agreement levels will be given. Therefore, that whichever objectives fits where accordingly with its agreement level and the agreement level of both pre and in-service teachers will be compared.
5. 6.The distribution of standards in the different cells in the taxonomy table for each occasion is compared to the distribution of the other occasion and as a measure of how similar the two distributions are the *emphasis index* is used. This index has been used by Porter (2002) for comparing the distribution of standards with the distribution of assessment items in alignment analyses, and used by Näsström (2009) to compare the teachers and experts' classifications of standards. The emphasis index is:

$$E = 1 - \frac{\sum |x - y|}{2}$$

where x is the proportion of the total number of categorized standards in each cell inthe taxonomy table for Panel 1 or Occasion 1 and y is the corresponding proportion for Panel 2 or Occasion 2. When E = 1, the distributions are the same and emphasize the same cells in the taxonomy table. E = 0 means that the distributions are completely different. Webb (2002) used a similar index for balance between standards and assessment items, and according to him index values of at least 0.70 indicate an acceptable level. Index values between 0.60 and 0.70 are, according to Webb, indicating an only weakly acceptable level.

Results

What is the frequency and percentage of the cells used in all categorizations presented in the Figure 4.

What is the number of the cells both used and not used during the study, the frequency of usage of cells, the number of the cells used each time by pre-service teachers, the number of the cells both used and not used by both pre and in-service teachers presented in the Table 4.

Table 4. The number of cells for categorizations

		Used cells	Non used	The number of cell which is most used	Non used cells for categorization by groups	non used cells by Both pre and in-service teachers	Used cells for all occasions	Non used any categorization	Used cells by both group and individual
Pre	Ind	23	1	73/360 (No:10) % 20,2					
	G1	9	15	17 /45 (No:10) % 37,7	Pre-service 9 cells		5 cells		
	G2	13	11	12/45 (No:16) % 26,6	No: 3,5,6,12,13,14,		No: 2,		
	F	11	13	10/45 (No:10) % 22,2	,20,21		8,10,16,24		
In	Ind	22	2	73/360(No:8) % 20,2		Both pre and in non used	10 cells No:	1 cell No:19	5 cells No: 2,8,10,
	G1	10	14	9/45 (No:8 and No:10)	In-service 6 cells	3 cells No:, 6,20,21	1,2 , 8,9,10,11,1		16, and 24
	G2	12	12	14/45 (No:8)	No: 6,7, ,18,		4,15,16,24		
	F	13	11	11/45 (No:8)	,20,21,22				

	Remember				Understand				Apply				Analyze				Evaluate				Create			
	Individually	G1	G2	Final	Individually	G1	G2	Final	Individually	G1	G2	Final	Individually	G1	G2	Final	Individually	G1	G2	Final	Individually	G1	G2	Final

Factual knowledge	Pre	f	21	0	3	6	20	3	2	4	5	0	0	0	4	0	3	1	2	0	0	0	1	0	0	0
		%	5,8	0	6,6	13,3	5,5	6,6	4,4	8,8	1,3	0	0	0	1,1	0	6,6	2,2	0,5	0	0	0	0,2	0	0	0
	In	f	21	5	3	4	29	5	5	3	4	0	0	2	9	0	3	1	0	0	0	1	2	0	0	0
		%	5,8	11,1	6,6	8,8	8	11,1	11,1	6,6	1,1	0	0	4,4	2,5	0	6,6	2,2	0	0	0	2,2	0,4	0	0	0
Conceptual knowledge	Pre	f	12	2	2	0	36	8	6	6	15	0	0	1	73	17	7	10	10	0	3	1	3	0	0	0
		%	3,3	4,4	4,4	0	10	17,7	13,3	13,3	4,1	0	0	2,2	20,2	37,7	15,5	22,2	2,7	0	6,6	2,2	0,8	0	0	0
	In	f	9	0	0	0	73	9	14	12	18	2	1	6	34	9	3	6	2	2	3	1	8	0	1	0
		%	2,5	0	0	0	20,2	19,9	30,8	26,6	5	4,4	2,2	13,2	9,4	19,9	6,6	13,2	0,5	4,4	6,6	2,2	2,2	0	2,2	0
Procedural knowledge	Pre	f	3	0	0	0	8	0	0	0	8	0	2	3	67	6	12	9	8	1	0	0	9	1	0	0
		%	0,8	0	0	0	2,2	0	0	0	2,2	0	4,4	6,6	18,6	13,3	26,6	20	2,2	2,2	0	0	2,5	2,2	0	0
	In	f	2	0	1	0	13	3	1	1	30	3	2	2	61	5	7	1	10	0	0	2	7	0	0	0
		%	0,5	0	2,2	0	3,61	6,6	2,2	2,2	8,3	6,6	4,4	4,4	16,9	11,1	15,4	2,2	2,7	0	0	4,4	1,9	0	0	0
Metacognitive knowledge	Pre	f	0	0	0	0	2	0	0	0	1	0	0	0	24	2	2	0	3	0	1	1	25	5	2	3
		%	0	0	0	0	0,5	0	0	0	0,2	0	0	0	6,6	4,4	4,4	0	0,8	0	2,2	2,2	6,9	11,1	4,4	6,6
	In	f	0	0	0	0	2	0	0	0	3	0	0	0	8	0	0	0	6	0	0	1	9	2	1	2
		%	0	0	0	0	4,4	0	0	0	0,8	0	0	0	2,2	0	0	0	1,6	0	0	2,2	2,5	4,4	2,2	4,4

Figure 4. The percentage and frequencies of the cells used. _Distribution _in per cent_ of total classifications of all standards on each occasion _Individually_ G1_ G2 and Final_

*Note: while there were 8*45=360 in individual classifications there happened to be 45 classifications each in groups and final. And this becomes the answer for the difference in percentages.*

In individual classifications the pre-service teachers used 24 cells while leaving one out. The most frequently used cell is conceptual knowledge dimension (74 times). The in-service teachers used 22 cells and leaving 2 ones out. The most frequently used cell by teachers is that of procedural knowledge dimension (61 times). None of the pre-and in- service teachers used the cell remember metacognitive knowledge (No:19), while all the other 23 cells were used by at least one pre- or in-service teachers on at least one occasion.

In G1 meetings by locating all of the objectives into 9 of the 24 cells the pre-service teachers used the conceptual–analyze cell most, on the other hand the in-service teachers positioned all the objectives into 10 cells out of 24 and the concept-understand and concept-analyze cell became them so frequently used ones with the rate of 9 times.

In G2 meetings, pre-service teachers settled the objectives into 13 cells out of 24 and used procedural-analyze cell 12 times on the other hand the in-service teachers put the objectives into 13 out of 24 cells and used concept-understand cell most frequently.

In final meetings the pre-service teachers put the objectives into 11 of the 24 cells and used procedural-analyze cell 10 times. On the other hand, the in-service teachers settled all objectives into 13 cells out of 24 and used concept-understand cell 11 times.

When we take classifications with groups (G1, G2, F) into consideration the pre-service teachers used only 15 cells leaving out 9 and in-service teachers used 18 cells leaving out 6 cells. 3 of these cells are the same for both parties. That is, number 6, 21 and 20 have not been employed by neither party.

In all classifications both individually and in groups, the number of the cells used by pre-service in all circumstances is 5 (2,8,10,16,24) while in-service teachers used 10 ones namely (1,2,8,9,10,11,14,15,16,24) and finally 5 (2,8,10,16,24) and number 19 has not been used by neither group.

What is consistency rate between the classifications (G1, G2, F) of pre and in-service teachers (Krippendorff's Alpha statistics) presented in Table 5.

Table 5. Krippendorff's Alpha statistics

		Krippendorff's Alpha
Individually	Pre	0.114
	In	0.057
G1+G2+F	Pre	0.217
	In	0.193
Both individually and G1+G2+F	Pre	0.168
	In	0.089
Both teacher and pre	Individually	0.087
Both teacher and pre	Group (G1+G2+F)	0.168

The consistency among the individual classifications of the pre-service teachers is 0,112 while that of the in-service teachers is 0,055. Notably the consistency among that of the pre-service teachers is higher than that of the in-service ones. In the classification of the teachers as final group of 8 and 2 groups (G1,G2) and individuals the consistency rate is 0,211 and its 0.187 for in-service teachers. Again the consistency of the pre-service teachers is higher than that of the in-service teachers. While the consistency among all classifications done by pre-service teachers (individual, +G1+G2+F) is 0,166 that of the in-service teachers is 0,087. The consistency of pre-service teachers' classifications is higher than that of the in-service teachers. The consistence between the pre-service and in-service teachers is 0.086 while that of the groups is 0.165. The consistency of group classifications is higher than that of the individuals.

What is the Average Pairwise Percent Agreement (%) Average Pairwise Cohen's Kappa of objectives in both individual and as group classifications presented in Table 6.

Table 6. Average Pairwise Percent Agreement _ Average Pairwise Cohens Kappa of objectives in both individual and as group classifications.

		Average Pairwise Percent Agreement (%)	Average Pairwise Cohen's Kappa
Individually	Pre	21.0	0.116
	In	15.4	0.067
G1 and G2	Pre	22.2	0.104
	In	24.4	0.273
G1 and Final	Pre	31.1	0.192
	In	35.5	0.139
G2 and final	Pre	44.4	0.362
	In	26.6	0.169
G1+G2+F	Pre	32.5	0.219
	In	28.8	0.194
Both individually and G1+G2+F	Pre	26.5	0.170
	In	18.5	0.095
Both teacher and pre	Individually	17.8	0.092
Both teacher and pre	Group (G1+G2+F)	26.8	0.171

As is clear in the table the accordance between pre-service teachers' GA1 and final classification is 31,1 while that of the GA2 and final is 44,4 and that of the GA1, GA2 is 22,2. In other words the number of the objectives put into the same cell is 14 while that of the GA2 and final is 20 and 10 for GA1 and GA2.

As it is evident from the table the consistency rate of the teachers in GT1 and final classifications is 26,667 and 24,4 for GT1 and GT2. That is to say the number of the objectives established in the same cell is 16 in both GT1 and final meetings while it is 12 for final and GT2 and eventually 11 for GT1-GT2.

The consistency percentage between pre and in-service teachers' individual classification is 17.815 (Kappa= 0.092) while that of the group classification is 26.815 (Kappa=0.171). The consistency percentage among group classification is higher than that of the individuals.

What is the number of the objectives put into the same cell in classifications and by how many people was it done presented in Table 7.

Table 7. Agreement level for each standards

	In-service Teachers	Pre-service Teachers
1: No agreement	10112, 10234	f:0
	f: 2	%0
	% 4,4	
2-3: Poor	3.10114, 3.10211, 3.10212	3.10112,3.10211,2.10212
	2.10213, 3.10214, 2.10221	2.10213,2.10214,3.10221
	2.10232, 2.10233, 3.10242	2.10232,3.10233,3.10234
	2,2.10252, 3.10313,2.10312	2.10241,3.10252,3.10311
	2.10314,3.10322,2,2.10331	2.10312,2.10313,3.10314
	2.10332, 3.10333, 2.10341	2,2.10321,2.10322, 3.10331
	3,3.10411, 2.10412,3.10421	2,2.10332,3.10343,2.10411
	3.10441, 3.10461, 2.10463,	3.10412,2.10421,2.10431
	3.10464, 2.10471, 3.10491	2,2.10441,2.10451,3.10461
	2.10493,2.104101,3.104103	3.10464,3,3.10471,3.10481
	f:30	3,3.10492,3,3.10493,3.104101
	% 66,6	f:33

		%73,3
4-5: Moderate	5.10111,4.10113,5.10231	4. 10111,4.10113,4.10114
	5.10241,5.10251,4.10313	5.10242, 4.10251,4.10323
	4.10321,4.10323,4.10431	4.10333,4.10462,4.10463
	4.10451,4.10462,5.10492	5.10491
	f: 12	f:10
	% 26,6	%22
6-7: Substantial	6.10481	6.10231
	f:1	f:1
	%2,2	%2,2
8: Perfect	f: 0	104103
	%0	f:1
		%2,2

Note: Each objective starts at 10. The number in front of 10 reveals that by how many people has the objective been put into the same cell. For instance 5.10111 code shows that number 10111 objective has been put into the same cell by 5 people.

Table 8. The frequencies and percentages of objectives with agreement levels

	Pre-service T	In-service T	Similar
1:	f:0	f: 2	0
No Agree	0	4,4	
2-3:	f:33	f:30	22
Poor A	73,3	66,6	
4-5:	f:10	f:12	5
Moderate A	22	26,6	
6-7:	f:1	f:1	0
Substantial A	2,2	2,2	
8:	f:1	f: 0	0
Perfect A	2,2	0	

Note: If one standard categorized in each cell by just 1 person (no agreement); 2-3 persons (Poor); 4-5 persons (Moderate); 6-7 persons (Substantial); 8 persons (Perfect).

As can be seen in the table the number of the objectives put into 8 different cells by 8 different teachers is 0. 33 objectives have been put into the same cell by 2 or 3 teachers, 10 objectives to the same cell by 5 or 4 and consequently 1 objective into the same cell by 6 teachers. The number of the objectives put into the same cell by 8 teachers is 1. As in the table 2 objectives were put into the same cells by 8 pre*service teachers while 30 objectives were put in the same cell by 2or 3 teachers, 12 objectives into the same cell by 4 or 5 teachers and consequently 1 objective was put in the same cell by 6 teachers. The number of the objectives put into the same cell by 8 teachers is 0. while 22 of the objectives where both pre-and in-service teachers have poor agreement upon are same 5 of the moderate agreement are same. While the number of the those with Substantial agreement is same, these objectives are different from each other. That is the objective put into the same cell have been put into different cells by 3 pre-service teachers. What is the Emphasis index among classifications presented in Table 9.

Table 9. Emphasis index

	Occasion 1 (x)	Occasion 2 (y)	E	Acceptable level*
Pre-service teachers	G1	Individually	0,40	Weakly acceptable level
	G2	Individually	0,80	acceptable level
	Final	Individually	0,70	
	Final	Group1	0,95	acceptable level
	Final	Group2	0,95	acceptable level
	Group1	Group2	0,90	acceptable level
In-Service Teachers	G1	Individually	0,80	acceptable level
	G2	Individually	0,90	acceptable level
	Final	Individually	0,65	
	Final	Group1	0,90	acceptable level
	Final	Group2	0,90	acceptable level
	Group1	Group2	0,80	acceptable level
Between pre- and in-service teachers	Pre-Final	In-Final	0,80	acceptable level
	Pre-Individually	In-Individually	0,65	Weakly acceptable level

**According to Webb (2002).*

In terms of Emphasis index, the E value is 0,70 between individual and final classifications, G1-INDIVIDUAL is 0,95 INDIVIDUAL-G2 is 0,90. As seen in the table the E score of final group classifications of both pre and in-service teachers are than that of the individual ones. The E scores between the individual classifications of both pre and in-service teachers is 0,65 while that of the finals is 0,80. With regards to E scores the rate of the group classification is higher than that of the individuals. This fact proves that classification with group is much more efficient.

Discussion

Usefulness of RBT

It has been observed that both pre and in-service teachers have put the objectives into the taxonomy table. This case shows that RBT is inclusive in classification of objectives as Näsström (2009) stated. Whether the cells in the taxonomy table mutually exclusive or not we can look that if one standard is placed in only one category. In this study one standard is placed in only one category by pre or in service teachers while, in her study, the judges were allowed to multi-categorize, i.e. categorize one standard into more than one cell, and the judges utilized this possibility, But, in our/this study the judges (pre-service and in-service teachers) has to categorize just one standard into one cell. Therefore, it is possible to say that the categories in Bloom's revised taxonomy are mutually exclusive. But in all classifications held in the process of study the researches have been present and done observations. In the classifications individuals have had troubles originating from the need of doing multi-categorization. Especially when in the case of two verbs of objectives they had trouble with which cell to put it and decision making has been left to them. For example, while the participants

classifying the standard "*By using the magnetic field concept, the students explain attractive and repulsive forces between the magnets and analyzes the variables that this force is connected",* they were discussed whether it will be in cell of understand or analyze.

When the level of inter- and intra-judge consistency are considered, Krispendorrf alpha percentages of agreement are quite low. This case proves that both pre and in-service teachers have differences in the classification of the objectives and that there is low rate similarity between group and individual classification. The reason may be objectives were not clear, plain and comprehensible and the objective composing principles were ignored could be count among the reasons. (Patton and Trainor, 2002; Popham, 2001; Wiggins and McTighe, 2005; Luft, Brown, and Slutherin2007; Näsström, 2009). This case can cause to teaching in different stages on the same subject by affecting the teaching techniques. When considering the alpha and kappa scores this situation can cause different teaching levels about the same level via affecting the teaching strategies. The individual alpha (0,086) and kappa (0,092) scores of pre-and in-service teachers' individual classification and those of the group classifications alpha (0,165) kappa (0,171) suggests that the consistency rate of group classification is much higher than that of the individual classification.

Taking applied classifications into consideration 23 cells from the 24 in the taxonomy table have been used at least by one teacher except for *metacognitive knowledge-remember*. This case shows that RBT table is efficient in the classification of the objectives.

As a result, we can say that according to Hauenstein's (1998) rules Bloom's revised taxonomy is a useful tool for classifications of standards of physics syllabus in this study.

Similarities and Differences Between Pre-Service and In-Service Teachers

The pre- and in-service teachers categorized the standards almost the same into cells in the taxonomy table (see Figure 1). In the classifications both pre and in-service teachers have employed more cells in individual classifications than in group classifications. In individual classification pre-service teachers have put the 45 objectives into 23 cells, in-service teachers put them into 22 cells while in the 8 people-group classifications pre-service teachers put them into 11 and in-service teachers put in 13 cells. Pre-service teachers used *conceptual-knowledge-understand* cell most frequently while in-service teachers put into *conceptual-knowledge-understand* cell. This case suggests that in alignment of objectives cognitive process dimension differences were visible than those of the information dimension. This case can be due to the experiences of both pre and in-service teachers and the lack of verbal dimension of objectives. While neither in- nor pre-service teacher used 1cell, they have used 5 cells in both individual and group classifications.

Considering the consistency in the study **(**Krippendorff's Alpha**,** Percent Agreement and Cohen's kappa) its rate is low for both parties. However, all classifications of pre-service teachers are higher than either of the in-service teachers. In fact, in-service teachers were supposed to give higher rates when considering their experiences. On the other hand, the knowledge of pre-service teachers on taxonomy, objectives were still fresh and what is more they had been

involved with a study with 9th grade and these must have affected the result scores.

The Vague and Broad Standards

The frequencies and percentages of objectives with agreement levels are considered, the pre- and in-service teachers categorized the same standards almost the same cells with same agreement levels. Teachers have been observed having poor agreement on more than half of the objectives (33 for pre and 30 for in service teachers and of 22 are the same) and moderated agreement almost on a quarter (10 for pre and 12 for in service teachers and of 5 are same) the number of the objectives on which both parties had higher rate of agreement is 1. This can be a result of objectives' being comprehensive and vague. And having such low agreement ratio on the objectives can have negative effects on teaching processes.

Taking Emphasis indexes into consideration it is clearly visible that the E scores of the pre-service teachers is higher than that of the in-service teachers. The E levels of both parties is comparatively higher than those of the individuals and finals. Still considering both parties' individual and final classifications, the E score between two finals is 0,80 higher than that between two individual classifications which is 0,65.

Limitation

The multi-categorization of objectives was not made possible for this study. But, researchers have been present and done observations during the whole period of the study. In the classifications performed the performers have felt the need for putting the objectives into multi-categorization and thereby experienced some problems. Especially in the case of two verbs the performers have had discussions which cognitive process to put the objectives and the decision was left to them.

The size of the samples in this study is quite small and this may have influenced the reliability negatively. However, a large number of judges also require a lot of resources as time, people and money, and therefore the level of acceptable reliability has to be weighed against the costs.

The teachers and pre-service teachers in this study are not fully representative of pre-in service teachers in general. They were in the same city and the researchers could arrive them. If a random sample of teachers had participated, the levels of inter- and intra-judge consistency could be expected to have been even lower than for the teachers in this study. Also, all the judges in this study are assumed to be familiar with the standards.

This study is also limited to standards in physics, while Bloom's revised taxonomy was developed for all academic subjects. Therefore, it is possible that studies with standards from other academic subjects than physics can give different results concerning the degree of usefulness of Bloom's revised taxonomy and the levels of inter- and intra-judge consistency.

Conclusions

How the standards are interpreted by teachers is important for planning of teaching and for learning outcomes. Because interpretation of standards is based on teachers' judgments, and, if the standards interpreted similarly or differently by teachers, they will teach similarly or differently ways and then, the outcomes

will be similar or different. But seem in this study, the low levels of inter- and intra-judge consistency, especially for the in-service teachers, indicate considerable differences in their classifications of standards. Therefore, it is important to study and report inter- and intra-coder consistency when standards are interpreted. As Näsström (2009) said experience of interpreting standards seems to be an important qualification for teachers. So, to increase the teachers' qualification, a more extended training session might be one solution.

One conclusion is that agreement in interpretation of standards has to increase, especially for teachers, to allow all students a fair chance to attain the same standards regardless of teachers and schools. The low levels of inter- and intra-judge consistency for the teachers may have negative effects on students' learning, on fairness in assessments.

To be able to recommend Bloom's revised taxonomy for interpretation of standards in general, further studies in other academic subjects than physics are needed. There are many academic subjects but a starting-point might be in subjects that often have standardized assessments.

One of the notable findings of this study is that one can know whether everyone comprehend the ambiguity of objectives in the same manner and this becomes possible through RBT. The agreement level for objectives (especially for 43 of 45 objectives) in this study is rather low. High agreement ratio was observed only on two objectives. In other words, just one objective was put into the same cell by everyone involved. Thus with the RBT it can be found out if the objectives in a teaching program is understood in the same way by everyone. Moreover, putting the same objective into different cells may mean that the objective has vague meanings. The motives of this situation should especially be studied. Whether low-agreement originates from negligence of writing criteria for objectives or from any other reason should be studied also the fashion in which an objective is written must be clear for anyone. Because, well-written learning objectives can give students precise statements of what is expected of them and provide guidelines for assessing student progress. Our goal for students is learning and if students don't know what they should be able to do at the end of class then it will be difficult for them to reach that goal. Clearly defined objectives form the foundation for selecting appropriate content, learning activities, and assessment measures. If objectives of the course are not clearly understood by both instructor and students, then the methods of assessment, which are supposed to indicate to both learner and instructor how effective the learning and teaching process has been, will be at best misleading, and, at worst, irrelevant or unfair. When a learning objective is well written and accurately describes what we want the participant to know or what knowledge to be gained then it will guide the instructor to properly developing and structuring the course.

Eventually, in the classification of objectives as seen in this study, that teachers come together and make classifications with RBT in groups enables the objectives that lead teaching-learning processes to be effectively evaluated and contributes to assessment and planning as well.

Disclosure statement

No potential conflict of interest was reported by the authors.

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